



ACQUIRING KNOWLEDGE

*The knowledge of the world
is only to be acquired in the world,
and not in a closet.*

Earl of Chesterfield, 1746

Understanding **CHRONIC WASTING DISEASE**

IF ANY NATURAL RESOURCES ISSUE IS LIKELY TO STAND OUT IN THE MEMORY OF THE 2001-2003 BIENNIUM, IT IS THE DISCOVERY OF CHRONIC WASTING DISEASE (CWD) IN WISCONSIN.

Science Services is currently engaged in CWD research with a goal of providing the scientific basis for managing the disease in Wisconsin and evaluating the success of the CWD eradication program that is being implemented. Researchers Jerry Bartelt, Robert Rolley, Tim Van Deelen, Brian Dhuey, and Jordan Petchenik are conducting research with partners from the University of Wisconsin, U.S. Geological Survey, and other agencies, as well as collaborating with other CWD research studies across the country.

Since Wisconsin is the first state east of the Mississippi River to discover CWD within a wild deer population, the implications of this research will have national impact. Other states are closely monitoring Wisconsin's response, which may be used as a model should CWD show up in other states. The results of CWD research are expected to affect wildlife professionals, hunters, landowners, taxidermists, meat processors, disposal/land-fill operators, animal damage control experts, and others.

Although the DNR has been sampling for CWD in Wisconsin since 1999, the problem exploded when test results for three deer harvested near Mount Horeb in the fall of 2001 came back positive for CWD. Immediately staff began compiling information on CWD and its control. Questions like, "How many deer need to be sampled in order to define the extent that the disease has spread?" and "What information is critical in order to manage CWD effectively?" had to be answered as soon as possible. As a result, the DNR, University of Wisconsin, U.S. Geological Survey, U.S. Department of Agriculture, Wisconsin Department of Agriculture, Trade, and Consumer Protection, Wisconsin Department of Health and Family Services, and others have collaborated to develop statewide and national plans for CWD research and management.

In Wisconsin's 2002 CWD management plan, complete depopulation of the deer herd was planned in the 411-square mile "Eradication Zone," the location where the first diseased deer were found. This was an attempt to eradicate the disease where we know it exists. In the 6,000 square mile area surrounding the "Eradication Zone" (called the "Special Herd Reduction Zone"), the goal was to reduce the deer population to 10 deer per square mile of deer habitat. It should be noted that the old formulas for estimating the size of the herd in Wisconsin will no longer apply in these zones

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chronic wasting disease

because of dramatic differences in harvest levels and conditions. In the past, formulas for estimating the size of the herd in Wisconsin were based on the sex, age, and kill data from a *stable harvest* over the years. The drastic reductions of the deer population in the “Eradication Zone” and the “Special Herd Reduction Zone” will create a need for a new way of estimating deer numbers in these zones. Currently, Science Services is developing surveys to estimate deer numbers using helicopters and fixed-wing aircraft.

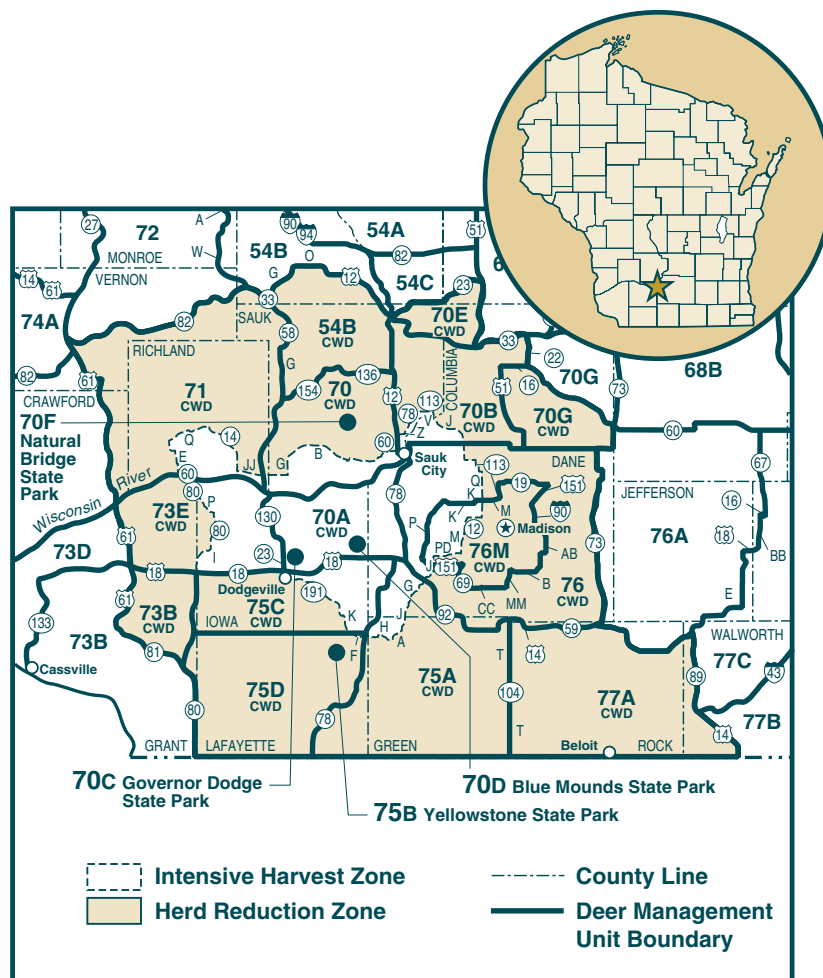
The CWD research plan consists of three separate projects that started in the fall of 2002. The first project, a radio-telemetry study, will help predict how quickly the disease may spread by increasing our knowledge of deer ecology. This study explores population dynamics, movements, and social behavior of deer. Currently, Nancy Mathews and Tim Van Deelen are capturing deer in the “Eradication Zone” with box traps or rocket nets, putting on radio collars and ear-tags, releasing, and tracking them (see side bar for more info). Buck fawns are being marked for dispersal information, while doe-fawn pairs are being marked to study social interactions. Information on how far the deer move, especially dispersing yearling bucks, will be a major finding of this project.

The second project is a disease dynamics study. This study will examine the distribution and prevalence of CWD in the “Eradication Zone,” the distribution of the disease with relation to the age and sex of the deer, and genetic relatedness among CWD-positive deer. Using the data obtained from the deer killed in the “Eradication Zone,” researchers will learn how the disease is transmitted within and among social groups of deer.

The third research project involves collecting data from hunters and landowners through surveys, interviews, or focused discussion groups to shed light on people’s attitudes related to the disease, human risks, and CWD management. This research project is important because the cooperation of landowners and hunters is critical in making the management plan succeed. Information has been collected during the 2002 hunting season and from people who purchased hunting licenses in 2001. Other information will be collected through telephone or mailed surveys from active hunters across the state (those that currently hold licenses) and landowners in the “Eradication Zone.” This research will provide insight into the economic effects that CWD has on the state and the resultant reduction of the deer herd. The ultimate goal of the economic research is to find out what impact a reduction of the deer herd has on crop damage, car-deer collisions, and revenue for meat processors, taxidermists, gas station operators, license sales, etc.



The outbreak of CWD in Wisconsin has resulted in a need to reduce the deer herd in the Intensive Harvest Zone ("Eradication Zone") and the Herd Reduction Zone. The advent of CWD has required researchers to closely study population dynamics, movements, and social behavior of deer. This research will be essential in providing a strong science base for management of the disease.



In addition to the three projects outlined above, the opportunity for further discovery is inherent in the research being done on CWD. Currently, one interesting proposal is seeking funding for a study of the ecological effects of the removal or reduction of the deer herd in the "Eradication" and "Special Herd Reduction" zones. Recently, two sites have been selected: one in the "Eradication Zone" (deer population near zero), and the other outside either of the targeted zones (populations at 25-35 deer per square mile). To compare the impact of the deer herd at different densities on the surrounding ecosystem, an extensive inventory will be taken in each of these two areas. Investigations will focus on the impacts a reduction in the deer herd will have on the vegetation, nutrient cycling, the presence of small mammals and birds, tree regeneration, and more.

The end result of all of these CWD research projects will be the preservation of a healthy deer population and the tradition of hunting in Wisconsin. The research is providing a strong science base for management of both the disease and the deer. ●

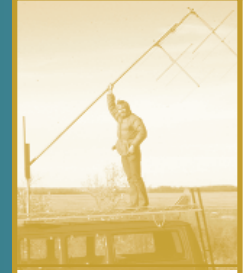
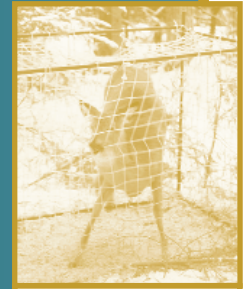
On the trail of the whitetail...

The spread of CWD into the Midwest has brought the unusual disease into the forefront of deer management. Like many of the conservation and environmental problems the department faces, the issues surrounding CWD are complex and involve making difficult choices. Applied research provides the information necessary for sound, science-based decisions.

Many of our current CWD questions relate to deer movements and social behaviors. With the support of our conservation partner, Whitetails Unlimited, and others, Science Services and the University of Wisconsin launched an intensive effort in the fall of 2002 to radio-collar and track whitetail deer in the area near Mount Horeb where deer have tested positive for the disease. Whitetails Unlimited donated a pair of 4-wheel drive pickups and a semi-load of deer traps to aid the study. The study is expected to last five years and could cost approximately \$500,000 annually in state and federal funding and private donations.

Our scientists hope to track deer movements, learn about their social groups, and provide sight-ability correction for helicopter counts. The effort could also help researchers determine whether CWD is more prevalent by age or gender and whether some deer are more or less prone to infection. Researchers will also look at the effect yearling buck dispersal might have on disease spread.

As with all of our adaptive management approaches, the study results could change the department's strategy for controlling CWD in Wisconsin.



Upper: deer in box trap.
Lower: radio-tracking.

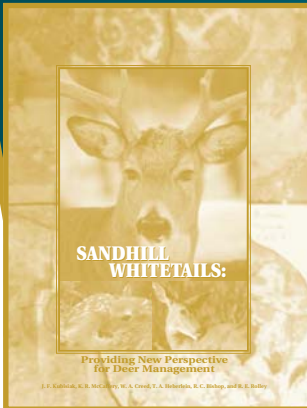
Providing perspective for deer management...

Wisconsin's Sandhill Wildlife Area – a 9,150-acre tract enclosed by a nine-foot high wire fence – is about as close as you can come to “test tube” deer management. Since the early 1960s, wildlife biologists have been manipulating deer populations at Sandhill through a variety of hunting strategies, studying the outcomes, and applying the resulting theories to the management of deer herds across Wisconsin. A cornerstone of our deer management program, the ecological and sociological research completed at Sandhill has influenced deer management throughout North America.

Now, this research has been pulled together, synthesized, and summarized in a single reference, the 282-page book *Sandhill Whitetails: Providing New Perspective for Deer Management* published by Science Services in July 2002. Retired DNR biologists John Kubisiak, Keith McCaffery, and William Creed authored the book along with their University of Wisconsin colleagues Tom Heberlein and Richard Bishop, and Robert Rolley of the Wildlife and Forestry Research Section.

“Whether you’re a college professor, student, hunter, or just a fan of Wisconsin’s whitetail deer, you’ll find something interesting in this book,” says co-author Kubisiak. “Especially today’s hunters, who are more educated and have access to much more information. I think they’ll have more appreciation for the science that goes into managing the state’s herd after reading this book.”

Sandhill Whitetails was published by Science Services with federal Pittman-Robertson Wildlife Restoration Act funding and additional support from two conservation partners, the R.K. Mellon Foundation and Whitetails Unlimited. The book sells for \$25.00 through the Wisconsin Department of Administration’s documents sales office.



Mercury and Loons:

A WILDLIFE RISK ASSESSMENT

HAVE YOU EVER WONDERED IF IT WAS SAFE TO EAT FISH CAUGHT IN WISCONSIN WATERS? ASK A LOON!

Mike Meyer is a Science Services wildlife toxicologist evaluating the impacts of mercury exposure and shoreline habitat loss on Common Loons in northern Wisconsin. This project is part of the final phase of an ecological risk assessment of mercury in the environment. The goal of the study is to establish the ecological risks of mercury and compare the relative risks of mercury to other stress factors in loon populations.

An Environmental Protection Agency (EPA) grant is providing the funding for this final phase targeted for completion in 2005. The EPA wants to use the results of this project to help establish a national policy for mercury emissions. If Wisconsin wants to regulate mercury emissions from industry, we need to know what the risk levels are related to mercury in the environment. Power companies have funded some phases of this research to ensure that good scientific data are available during the regulatory decision-making process. With funding provided by both the regulator and the regulated, the partnerships involved are significant.

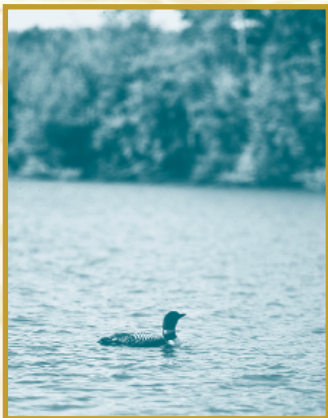
Despite the bans on toxic substances and pesticides in industry and agriculture, harmful chemicals still remain in the environment. Specifically, mercury contaminates many aquatic ecosystems, mostly through atmospheric deposition. As a result, air and water quality are both at risk. Since this toxic substance can accumulate in the bodies of predators (bioaccumulation), there is concern that in aquatic ecosystems predators that eat fish contaminated with mercury will become unhealthy. In this state alone, the mercury content in fish prompts fish consumption advisories in more than 300 lakes!

Bioaccumulation of mercury can impair the productivity of predators at the top of the food chain. Since they spend most of their lives in aquatic environments, these top predators (Bald Eagles, Osprey, and Common Loons) are good indicators of ecosystem health. The focus of this project is to document mercury levels in loons and fish from selected lakes, evaluate the impacts of mercury on loon reproduction, and identify what factors affecting mercury exposure will determine the magnitude of this ecological threat.

By determining the level of mercury in fish that is a risk to loons, and what portion of the loon population consumes fish containing that level of mercury, this study will determine the level at which we need to limit our mercury emissions in order to safeguard wildlife. Additionally, this study will also examine the effects mercury has on the loon population as a whole.

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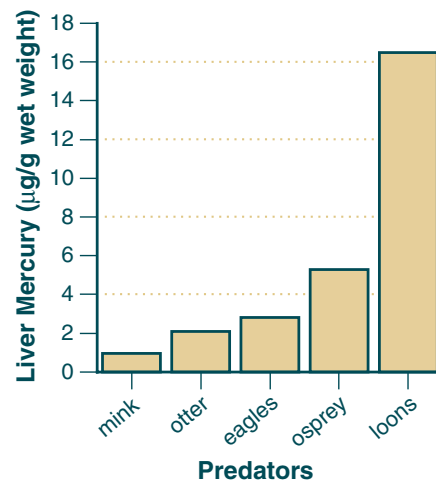
mercury and loons

Currently, the loon population is being randomly sampled to see what percentage of the population is at risk and to put the risk of mercury in perspective with other stress factors that may affect loons. To establish population estimates, researchers are randomly sampling lakes in a five-county area. They search each lake for loons, counting any that they see. By observing loon behavior, researchers can determine whether or not the loons are breeding pairs. Once breeding pairs are identified, the lakes are re-surveyed on a weekly basis and observations on nest success and hatching success are recorded. In addition, using Geographic Information System data, researchers are able to map the lake for shoreline development, nest location, and habitat quality. They will even capture the loons and take blood samples to assess blood mercury concentrations. So far, approximately 900 loons have been sampled and have helped researchers learn a lot about their natural history. Satellite transmitters have been attached to young loons to help determine migration routes. Additionally, water chemistry is measured for pH, conductivity, alkalinity, and clarity; and mercury levels of prey items (e.g., fish, crayfish, insects, etc.) are determined.

An important aspect of this research project is that it addresses the issue of land use. Land around lakes is being developed at an unprecedented rate. If revised zoning regulations are to be justified for Wisconsin lakeshores, it is critical that we have information about the impact of lakeshore development. It happens that loons are a good indicator species for the health of lakeshores, since these birds require shoreland areas to nest. Studying the impacts of lakeshore development would be incomplete without quantifying the effects of human recreation and other disturbances on loon behavior. For this part of the study, researchers observe loon families over a period of time, estimating the distances between loons, human activity (e.g. boats, water skis, swimming, etc.) and eagles or other predators. They note what behavior the loons exhibit as a response to each type of disturbance.

With potential impacts within the state and at the national level, Wisconsin's loon research in is a fine example of science contributing to the regulatory field. This project is arguably the most complete wildlife risk assessment conducted in this state. ●

Examining data from the Wisconsin Wildlife Contaminant Database from 1985-1995 suggests wildlife predators whose diet consists mainly of fish contain greater amounts of mercury in their bodies compared to those predators whose diet consists of a mixture of fish and other items.



One-stop shopping for data...

The Aquatic and Terrestrial Resources Inventory (ATRI) concept was developed in the early 1990s by DNR staff and external partners who recognized the need for decision makers to access and integrate environmental information. After considerable analysis concerning the role and structure of ATRI, a Wisconsin statute directed the DNR to "develop an information system to acquire, integrate, and disseminate information concerning inventories and data on aquatic and terrestrial natural resources." The ATRI program is managed through Science Services' Ecological Inventory and Monitoring Section and seeks to promote the integration and distribution of quality environmental data and decision-making tools through the development and implementation of data standards, the distribution of grants, data access, and the development of decision-making tools.

The ATRI "Metadata Explorer" is a computerized card catalog designed to help locate ecological data. Through the "Explorer," anyone can learn about and access data that will help them in their day-to-day operations. With over 300 complete files of metadata (i.e., information about who manages the data, the time period covered, methodologies used, etc.) on plants, wildlife, groundwater, and other resources, the program is relevant to all DNR staff searching for ecological data! You can query by county, by species, or whatever category you need, and get the contacts for the data. Jim Woodford and Jill Rosenberg are the lead staff on this project. They contact researchers concerning the metadata for new datasets making sure the data meet minimum standards and keep the database current by adding approved metadata.

The ATRI program sponsored the development of department-wide standards governing the areas of data collection, data structure, meta-data, and taxonomy. With the adoption of these standards, the program has turned its attention to an analysis of implementation needs and the distribution of grants enabling programs to bring data sets up to the standards. The ATRI grant program also supports the collection of inventory data and the development of computer programs that will allow data and other information to be shared.

ATRI's decision-making tools will allow users to query and integrate data. Toward that end, the ATRI program has embarked on an ArcIMS development project with the University of Wisconsin's Herbarium. These activities represent an ecosystem approach to the management of our state's natural resources. Anyone with a computer can create and print maps using the project's geographic information system

(GIS) databases! The resource is available in such a way that anyone can access it over the Internet to make sound, science-based decisions. The interdisciplinary nature of the project across professional lines is invaluable.

ATRI has recently undergone a program review representing different perspectives from DNR staff, external partners, and consultants from the Department of Electronic Government. The recommendations of ATRI customers and external partners have resulted in a new, more effective direction for the program. The most important outcome of the review was a focus on shared data integration, direct customer access to tabular and spatial data via the Internet, and expansion of the ATRI grant program.



Our Aquatic and Terrestrial Resources Inventory (ATRI) partners...

EXTERNAL PARTNERS

University of Wisconsin-Madison Herbarium . . .	Checklist of the Vascular Plants of Wisconsin
University of Wisconsin-Stevens Point	Wisconsin Macroinvertebrate Database
Milwaukee Public Museum	Wisconsin Herpetological Atlas
Wisconsin Society of Ornithology	Wisconsin Breeding Bird Atlas
University of Wisconsin-Madison	Wisconsin Beetle Inventory
University of Wisconsin-Milwaukee	Water Quality and Aquatic Habitat Data within the Milwaukee River Watershed and Nearshore Lake Michigan
Milwaukee Public Museum	Aquatic Invertebrate Database
Chippewa County	Chippewa County Forest Biotic Inventory

TECHNOLOGY PARTNERSHIPS

University of Wisconsin-Madison Herbarium . . .	Web-Mapping Development
Land Use Planning - Wisconsin Department of Natural Resources . .	Internet Mapping Tools for Comprehensive Planning

PROJECT NAME

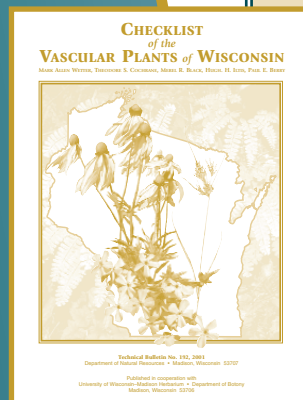
PROJECT DESCRIPTION

Naming Wisconsin's biological diversity...

Standardized checklists provide a ready reference for many scientific endeavors, both in the field and laboratory, and are particularly useful to teachers and students. Checklists are the primary tools for scientists to keep track of an area's biological diversity. During the past biennium, Science Services published two important updated Wisconsin checklists.

In cooperation with the Aquatic and Terrestrial Resources Inventory, staff at the University of Wisconsin-Madison Herbarium produced a vascular plant checklist in 2001. Although a number of local floras and a handful of detailed treatments of certain plant groups have been published since 1883! The new checklist prepared by Mark Allen Wetter, Theodore Cochran, Merel Black, Hugh Ittis, and Paul Berry provides an authoritative listing of all known native and introduced vascular plants that occur and reproduce in Wisconsin outside of cultivation. The checklist is based exclusively on herbarium specimens, a standard that allows individual species records to be verified. Special symbols indicate species of particular conservation and ecological interest. Completion of the checklist represents an important step toward development and publication of a complete Wisconsin flora.

Science Services also published a comprehensive listing of the 159 fishes, 19 amphibians, 35 reptiles, 408 birds, and 72 mammals occurring in the state. The *Checklists of Wisconsin Vertebrates* book by Dreux Watermolen and Matthew Murrell was published in 2002. "We review the Wisconsin literature for each group and summarize current atlas and inventory efforts," explains Murrell. "Individual checklists catalog current scientific and standardized common names for each species and species group, and iconic symbols provide status information for species considered introduced, endangered, or threatened." The authors also identify extinct and excluded species and provide more detailed status information for birds found in the state. Electronic versions of these checklists are available on the worldwide web.



Network of Ecological Monitoring Stations **BEGINS WITH SMALL MAMMALS**

THE IDEA FOR A STATEWIDE TERRESTRIAL RESOURCE INVENTORY RESULTS FROM THE NEED FOR DATA CONSISTENCY AMONG BIOLOGISTS FROM DIFFERENT AGENCIES.

Efforts began more than 10 years ago with the creation of the Aquatic and Terrestrial Resources Inventory (ATRI) and the need for a more comprehensive data collection design that would be useful to all researchers. As a result, Science Services' ecological inventory and monitoring program began developing a sampling framework to fill data gaps for all terrestrial resources in Wisconsin. The sampling framework is generally modeled after U.S. Environmental Protection Agency protocols, but is modified to provide data that fit the management needs of Wisconsin.

With a common research design, the benefits of the different pieces of research will be maximized by the standardized methods of data collection and reporting. For example, each group of researchers could add their data to a statewide data set and extract data that others collected at the same location. This information on birds, small mammals, reptiles and amphibians, and vegetation could contribute to the ecosystem-wide understanding of a geographic area. This 'data sharing' ability and resulting analysis will better support the department's ecosystem management decision-making process.

The purpose of the statewide terrestrial inventory project is to set up a network of ecological monitoring stations that can be used by biologists studying different species in different landscapes across the whole state! "Currently the project is in its formative stages", Loren Ayers, a Science Services terrestrial ecologist explained. "So far, background mapping through GIS is being done, the small mammal survey is being piloted, and a herptile survey is planned for the spring".

The small mammal survey, the backbone of the project, is being funded by a \$240,000 State Wildlife grant. It is the first such effort to survey small mammals in Wisconsin since the 1961 publication of *Mammals of Wisconsin* (UW Press)! There are over 40 mammal species found in Wisconsin that are smaller than a raccoon. These include mice, voles, shrews, chipmunks, squirrels, and weasels. Small mammals often form the prey base for larger, predatory animals. For example, what would happen to some of our raptor species if small mammals disappeared? Small mammals are also interesting to watch and available to observe.

Dick Bautz is a Science Services researcher helping lead the small mammal survey. He travels to selected sites in specific habitats and sets a variety of

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ecological monitoring

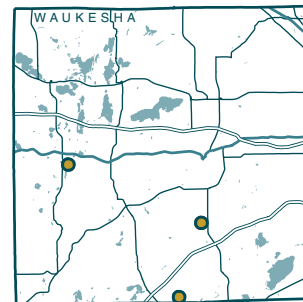
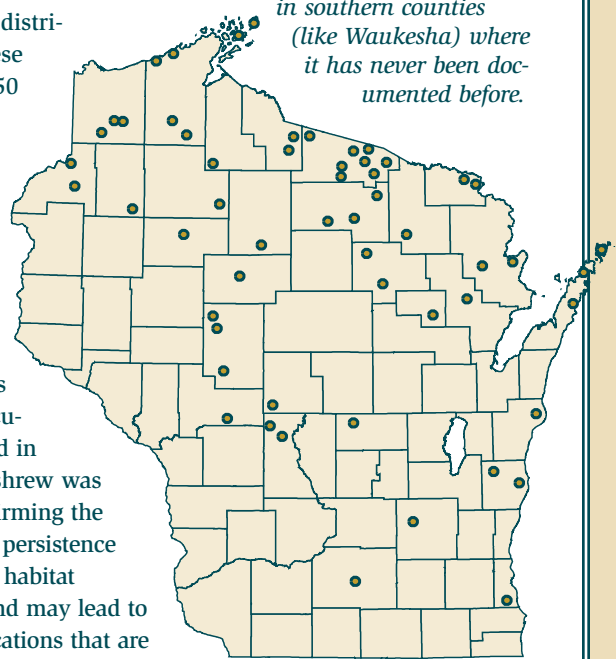
traps designed to catch various small mammals. The traps are checked the following morning and each mammal is identified, measured, weighed, sexed, and aged. Additional information about the habitat, like weather and time of day, is also recorded. The small mammal survey is designed to provide population information on local and regional distributions, relative abundance, and habitat associations. In addition, the project will identify population trends and status, the effects of land use and management practices, and prevalence of disease.

Currently, Science Services is using a nationally recognized land classification system to make early predictions about the current distribution of Wisconsin's small mammal species. Many of these species have not been systematically inventoried for over 50 years and much has changed in the Wisconsin landscape during that time. After adding land cover information to improve the detail, maps for various mammal species will help Science Services identify priority locations for survey work over the next 5-10 years.

What has Science Services found? This study has documented that Red-backed Voles are present in Waukesha County where they have never been documented before! (see map). The study has also confirmed the presence of this species in areas of Washington County where it was last documented over 30 years ago. Prairie deer mice have been found in grassland and wetland areas in Dane County and an Arctic shrew was found in coniferous wetland areas in Jefferson County. Confirming the existence of these small mammals is an encouraging sign of persistence by wildlife species that have been surrounded by decades of habitat change. Continued searching may reveal new information and may lead to readjustments of threatened and endangered species classifications that are more consistent with biological reality.

Do you need information on reptiles, amphibians, birds, insects, or plants? With the construction of a complete ecological picture from the network of inventory stations this project creates, the statewide terrestrial inventory will provide new knowledge and insights into the management and enjoyment of our natural resources. ●

The red-backed vole (Clethrionomys gapperi) has persisted in Wisconsin despite decades of habitat change. Historically, this species has been prevalent in the northern parts of the state as compared to the south. But only recently, as part of the terrestrial inventory project, has this rodent been discovered in southern counties (like Waukesha) where it has never been documented before.





Enhancing our mussel...

Freshwater mussels, commonly called clams, fill a variety of ecological roles and are essential to maintaining the integrity of aquatic ecosystems. "Mussels help maintain water quality through their filter feeding, provide a stable forage base for fish, furbearers, and other wildlife species, are potentially useful environmental indicators, and have commercial values," according to Science Information Services Chief Dreux Watermolen. Freshwater mussels, unfortunately, also comprise one of the most endangered faunas in the United States, with 18 mussel species currently listed as state endangered or threatened in Wisconsin and several others considered "special concern" species.

While mussel population declines have been documented and threats are relatively well known, a comprehensive survey of Wisconsin's mussels has never been completed. Department scientists find it difficult to predict the likelihood of a mussel population for any given water body. Previous inventory work was often qualitative or restricted to a limited number of water bodies or sampling sites.

The resulting lack of knowledge sometimes precludes us from fully assessing the impacts of proposed projects or demonstrating that an "incidental take" from a proposed project will, or will not, jeopardize the survival of listed species. In recognition of this situation, the Wisconsin Department of Transportation provided Science Services over \$100,000 to compile a comprehensive baseline inventory linked to geographic information system (GIS) maps, develop a rapid quantitative assessment methodology for pre-project screening, and devise a quantitative sampling protocol. Several scientists are carrying out the project under the direction of Fisheries and Habitat Research Section Chief Ed Emmons.

The project lays the necessary groundwork for a potentially much larger effort to document the distribution, relative abundance, and status of Wisconsin's mussel resources. Benefits of this effort also include:

- More effective and efficient regulatory enforcement,
- Identification of priorities and a solid basis for future mussel survey efforts,
- Strengthened state agency partnerships, and
- Additional information for endangered species listing decisions.

The comprehensive database was compiled and automated in 2002. Project scientists will complete field-testing for the quantitative sampling protocol and deliver a final report in 2003.